



DEPARTMENT OF AUTOMOTIVE AND AERONAUTICAL ENGINEERING

# Assessment of Numerical Models for Thrust and Specific Fuel Consumption for Turbofan Engines

Task definition of a *Diplomarbeit* at Hamburg University of Applied Sciences

## Background

Aircraft performance calculations are based on a) equations derived from first principles, b) a simplified representation of the aircraft engine and c) a simplified representation of the aerodynamics of the aircraft. The simplest way of representing a jet engine in cruise is to assume that relative thrust varies with relative air density  $T/T_{SL} = a \sigma^n$  ( $a$  and  $n$  may be a function of bypass ratio) and that the specific fuel consumption (SFC) has a fixed value. The aerodynamics are often represented by the simple drag polar  $C_D = C_{D0} + C_L^2/(\pi A e)$ . Better models for b) and c) are needed to improve the accuracy of performance calculations.

## Objective

The thesis shall improve simple aircraft performance calculations by providing simple though more accurate turbofan engine thrust and SFC models.

### Primary objectives:

- find models describing the thrust change with height and speed
- find models describing the change in SFC with height and speed
- compare the found models with reality (if possible)
- evaluate which is the most accurate / useful approach

### Secondary objective:

- evaluate the influence of power off-take on thrust and SFC

The results have to be documented in a report. The report has to be written in a form up to internationally excepted scientific standards. The application of the German DIN standards is one excepted method to achieve the required scientific format.



The thesis is prepared at the University of Limerick, Department of Mechanical & Aeronautical Engineering. Supervisor is Dr. Trevor Young.